

The Effect of Supply Chain Management Practices on Supply Chain and Manufacturing Firms' Performance

Purpose - This paper theorises and develops seven dimensions (strategic supplier partnership, level of information sharing, quality of information sharing, customer service management, internal lean practices, postponement and total quality management) into a SCM practices (SCMPs) construct and studies its causal relationship with the conceptualised constructs of supply chain performance (SCP) and manufacturing firms' performance (MFP). The study also explores the causal relationship between SCP and MFP.

Design/Methodology/Approach - Data was collected through a survey questionnaire responded by 249 Jordanian manufacturing firms. The relationships proposed in the developed theoretical framework were represented through three hypotheses: H1: there is a significant relationship between SCMPs and SCP; H2: there is a significant relationship between SCMPs and MFP; and H3: there is a significant relationship between SCP and MFP. Linear regression, ANOVA and Pearson correlation were used to test the hypotheses. The results were further validated using structural equation modelling (SEM).

Findings - The results indicate that SCMPs have a positive effect on SCP (H1), which in turn also positively affect MFP (H3). Despite this intermediary positive effect of SCMP on MFP through SCP, the study also suggests that SCMPs have a direct and positive effect on MFP (H2).

Practical Implications - This study provides hard evidence indicating that higher levels of SCM practices can lead to enhanced supply chain and firms' performance. It also provides SC managers of manufacturing firms with a multi-dimensional operational measure of the construct of SCMPs for assessing the comprehensiveness of the SCM practices of their firms.

Originality/Value - This study is among the very first SCM researches conducted on the Jordanian manufacturing sector, particularly, in relation to the practices that manufacturing firms in this country need to adopt to make their supply chains a solid competitive vehicle for their development. The results have broader implications for all manufacturing companies, particularly in developing economies where the growth of manufacturing and the development of integrated supply chains are key stages in economic development.

Keywords: Supply chain management, practices, manufacturing firms' performance, supply chain performance.

Paper Type: Research Paper

1. Introduction

Supply chain management (SCM) has nowadays become a crucial strategy for firms to enhance their profitability and stay competitive (Li *et al.*, 2006). Thus, SCM has been recognized as an important phenomenon that has generated extensive interest among

managers and academic researchers. Thus, over the last decade, scholars have increased the degree of attention paid to SCM. This has resulted in a rich stream of research, mainly focused on particular aspects of the field of SCM that include, among others; supplier selection (e.g. Igarashi *et al.*, 2013; Inemek and Tuna, 2009), supplier involvement (e.g. Johnsen, 2011), supplier alliances (e.g. Kannan and Tan, 2004; Lee *et al.*, 2009), supplier management (e.g. Reuter *et al.*, 2010), upstream supply chain related research (e.g. Oosterhuis *et al.*, 2012; Finne and Holmström, 2013), manufacturer and retailers linkages (e.g. Li and Zhang, 2015), supply chain resilience (e.g. Carvalho *et al.*, 2014), SCM practices (e.g. Zimmermann and Foerstl, 2014; Li *et al.*, 2006; Li *et al.*, 2005), sustainable and green supply chains (e.g. Choi, *et al.*, 2016; Kumar *et al.*, 2015), etc.

The wide and diverse stream of research conducted into different aspects of SCM may be explained by the interdisciplinary nature of this subject area. Therefore, SCM is considered as a multidisciplinary field that has been explored from many different perspectives (Papakiriakopoulos and Pramataris, 2010). Mainly, the concept of SCM has been considered from two alternative perspectives: purchasing and supply management. These perspectives emphasize purchasing and materials management as a basic strategic business process, rather than a narrow specialized supporting function (Narasimhan *et al.*, 2008; Sandberg, 2007); transportation and logistics management, which focuses on integrated logistics systems (e.g. inventory management, vendor relationships, transportation, distribution, warehousing and delivery services) that lead to inventory reduction both within and across firms in the supply chain (Banomyong and Supatn, 2011; Cook *et al.*, 2011).

However, despite the rich stream of research in this subject area, Cigolini *et al.* (2004) and Li *et al.* (2006) consider that scholarly research has been limited in contributing to the practice of SCM. They have attributed this not only to the interdisciplinary nature of SCM but also to its evolutionary characteristics, which according to them have created a conceptual confusion in its understanding. Although these factors may have contributed in the creation of a gap between the SCM theory and its applicability to practice, the generic nature of the research conducted may have also played a significant role on this. Thus, studies of the precise SCM practices adopted by specific countries and industries allow their distinctive characteristics to be understood within particular contexts. This therefore contributes in bridging the gap between the SCM theory and its application. In this line, various SCM studies have been conducted in various sectors such as automobile (Blos *et al.*, 2009; Zhu *et al.*, 2007), pharmaceutical (Papalexli *et al.*, 2016), toy (Wong *et al.*, 2005), apparel/textile (Abaylaev *et al.*, 2014), chemical (Foerstl *et al.*, 2010), telecommunication (Reyes *et al.*, 2002), agriculture/food (Dani and Deep, 2010), aerospace (Sinha *et al.*, 2004), electronics (Blos *et al.*, 2009), construction (Saad *et al.*, 2002), etc. Similarly, studies of various SCM aspects tend to be focused on developed countries and their interaction with developing economies as sources of supply as well as on some developing nations such as China (Zhu *et al.*, 2007), Brazil (Blos *et al.*, 2009; Diniz and Fabbe-Costes, 2007), Taiwan (Chow *et al.*, 2008) and Kyrgyz Republic (Abaylaev *et al.*, 2014). Taken together, these studies present the efforts made by researchers to understand SCM practices within specific industrial and country contexts. However, despite this, there is a lack of studies on SCM in relation to the practices that manufacturing firms in developing countries need to adopt to make their supply chains a solid competitive vehicle for their development. Jordan's economic, political and geographical characteristics as well as its current state of expanding manufacturing sector, and potential gateway to North Africa and the Middle East, makes the supply chains of its manufacturing sector different to all those previously studied (e.g. Zhu *et al.*, 2007; Blos *et al.*, 2009; Abaylaev *et al.*, 2014). Jordan's developing economy dominated by manufacturing SMEs and with limited but developing transport infrastructure, makes it a unique context that

demands further investigation. This justifies the opportunity of studying the SCM practices of the Jordanian manufacturing sector, in its own right, for the SCM theory to be able to understand its particular characteristics and in this way contribute to its practice.

The purpose of this study is therefore to empirically test a framework identifying the relationships among the SCM practices of Jordanian manufacturing firms, the performance of their supply chains, and the performance of their whole firm. To conduct this study, SCM practices are defined as a multi-dimensional concept, including both sides of the SC (i.e. downstream and upstream). The seven SCMPs considered in this study were developed, tested and validated in the literature by researchers such as Li *et al.* (2006), Green Jr *et al.*, (2008), Tan (2002) and Cook *et al.* (2011). These practices are considered crucial, and they cover both upstream and downstream sides of the SC. Using data collected through a survey questionnaire, operational measures developed for the constructs are empirically tested. Inferential statistics and structural equation modelling (SEM) are used to test and validate the hypothesized relationships. This study thus aims to help researchers, and specifically, manufacturing firms to better understand the scope and activities associated with their SCM practices that have a prominent role not only on the performance of their SC but also the entire firm. By considering both sides of the SC, this study allows researchers to test the antecedents and consequences of SCM practices, and also in the context of a specific developing sector and country. The study therefore provides a useful guidance for Jordanian manufacturing firms as well as a validated instrument for them to measure and implement SCM practices. The study also contributes to the academic theory by expanding the limited current body of knowledge on SCM in developing countries context (e.g. Li *et al.*, 2006; Min and Mentzer, 2004; Cigolini *et al.*, 2004).

This study aims at addressing the following research questions: 1) What SCM practices apply to manufacturing firms in Jordan? and 2) Is there any relationship between the current SCM practices that are adopted by manufacturing firms in Jordan and manufacturing firms' performance?

The rest of this paper is organised as follows: Section 2 presents the theoretical research framework and provides a review on the definitions and theory that underline the constructs and dimensions that comprise it; the research methodology and analysis of results are then presented in Sections 3 and 4 respectively; these results are then discussed in Section 5; while Section 6 provides the conclusions derived from this study.

2. Theoretical research framework

Figure 1 illustrates the theoretical research framework developed for this research. The framework allows the understanding of the antecedents and consequences of SCM as described by the causal relationships between SCM practices, SC performance and MFP (see Figure 1). The framework is underlined by the rationale that a high degree of SCM practices will lead to higher levels of SC performance and hence the enhancement of firm's performance. In particular, the framework proposes that SCM practices will not only have a direct impact on firm's performance but also an indirect effect through SC performance (Li *et al.*, 2006). As a consequence, SCM practice is conceptualised through a seven-dimensional construct as indicated in the SCM practices' box in Figure 1, whereas SC and firms' performance are conceptualised through four and two-dimensional constructs respectively (see Figure 1). These dimensions were tested and validated by various researchers (Li *et al.*, 2006; Green Jr *et al.*, 2008; Tan, 2002; Cook *et al.*, 2011), and were considered as significant factors that affect manufacturing firm performance.

2.1 SCM Practices

SCM includes a set of individual functional entities and practices for enhancing the long-term competitive performance of individual firms and their supply chain as a whole by integrating the internal functions within the firm and effectively linking them with the external operations of suppliers, manufacturers, distributors, customers and other channel members (Kim, 2006). SCM encompasses all activities, which are involved in planning and management, sourcing and procurement, conversion and all logistics management activities as well as coordination and collaboration with channel partners (Soosay *et al.*, 2008).

There are many definitions of the SCM concept in the literature. According to Feldmann and Muller (2003), there is no generally accepted definition of SCM in the literature. SCM definitions are classified into three categories: integrated logistics management, purchasing and supply management, and integrated SCM. Some of these definitions are presented in Table1.

Insert Table 1 in here

From the previous definitions, it is clear that the SCM concept reflects the reality of SCM as a strategic, managerial philosophy, and practice containing all SC partners – from suppliers, manufacturers, to customers – achieving better performance, gaining competitive advantage, and increasing customer satisfaction. For this research, SCM is defined as “*a process of coordination of the business functions across the businesses within the firm and across businesses within other firms in supply chain for providing and improving products and information flows from suppliers till end customers in order to enhance firm performance and satisfy customer needs, wants, and requests*”, which is aligned with the integrated SCM stream.

SCM practices are implemented to achieve and enhance performance through supply chain, which require an internal cross-functional integration within the firm and external integration with suppliers and customers to be successful (Kannan and Tan, 2010; Kim, 2006). In developing countries, Jordan in particular, most of the entrepreneurs and managers generally ignore the concept of SCM, and even where it is applied, it is done partially lacking its true spirit and totality (Jraisat, 2010; Abu-Alrejal, 2007).

Traditional production/distribution processes have been radically changed across many countries and most firms are obliged to redesign their manufacturing network (Chan and Lam, 2011). Therefore, still there are many challenges facing firms, e.g. getting a product and/or service at the right time and place, in the right quantity, and at the lowest cost. Many firms began to realize that it is not enough to improve efficiencies just within the firm, but also in their whole supply chain. The growth and development of SCM is not driven only by internal motives, but also by a number of external factors such as: increased globalization, reduced barriers to international trade and improvements in information availability, and environmental concerns. Therefore, some factors that provided stimulus for the development of existing trends in SCM include: computer generated production schedules, increasing importance of controlling inventory, government regulations and actions such as the creation of a single European market, establishing Qualified Industrial Zones (QIZs), and the Guidelines of Global Agreement on Tariff and Trade (GATT) and World Trade Organization (WTO) (Gunasekaran *et al.*, 2004). Practicing SCM is considered an essential prerequisite to staying in the competitive global race and to growing profitability (Moberg *et al.*, 2002).

Various researchers have represented SCM practices from a multiplicity of perspectives, but all of them converge in the fact that their ultimate goal is to improve the performance of firms (Li *et al.*, 2006; Li *et al.*, 2005; Tan *et al.* 1998; Chen and Paulraj, 2004; Min and Mentzer, 2004). The SCM practice construct used in this research amalgamates these research findings into the seven dimensions shown in Figure 1. A discussion of the seven dimensions considered as part of the SCM practice construct is provided below.

Insert Figure 1 in here

2.1.1 Strategic Supplier Partnership

Strategic Supplier Partnership (SSP) is defined by Li *et al.* (2006) as “the long-term relationship between the organisation and its suppliers”. It focuses on direct, long-term association and it is interested in mutual planning and problem-solving efforts (Arawati and Zafaran, 2008). Therefore, it is designed to enhance the operational and strategic efforts and capabilities of individual participating firms to achieve their goals (Li *et al.*, 2005). An effective supplier partnership is a critical component of leading edge supply chains (Arawati and Zafaran, 2008).

2.1.2 Level of Information Sharing

Level of information sharing (LIS) is defined by Li *et al.* (2006) as “the extent to which critical and proprietary information is communicated to one’s supply chain partner”. Shared information can vary from strategic to tactical in nature and from information about logistics to customer and general market information (Min and Mentzer, 2004). Increasing attention on information integration prompts the increase of the establishment of strategic SC partners (Zhou and Benton, 2007). This construct has been previously tested and validated by various authors such as Li *et al.* (2006), Li *et al.* (2005) and Wong *et al.* (2005). Knowledge management (KM) practices can support learning and growth of a manufacturing firm and its linkage to its supply chain. KM practices are based on information sharing of the supply chain tiers’ shared experience and practices, and learning with respect to their mutual matters existed throughout their SC network. The performance indicators for manufacturing firms’ performance and supply chain performance indicated in the paper can help measuring the level of development of the firm’s knowledge, skill-set, and behavioural aspects. This will facilitate producing a harmony within a company about how operations should be accomplished through internal integration, and it can be responsive to the supply chain requirements through its external integration to supply chain tiers.

2.1.3 Quality of Information Sharing

This dimension includes facets such as timeliness, accuracy, adequacy and credibility of information exchanged (Li *et al.*, 2006). According to Li and Lin (2006), ensuring the quality of shared information plays a key role in achieving effective SCM, and hence Li *et al.* (2006) suggest that organisations should ensure that it flows with minimum delay and distortion. Given the importance that quality of information sharing has been given in the academic literature in relation to its effect of SCM (Li *et al.*, 2006; Li and Lin, 2006), this has been included as one of the dimensions of the SCM practice construct.

2.1.4 Customer Relationship Management

According to Lee *et al.* (2007), customer relationship management (CRM) is “concerned with planning, implementing, and evaluating successful relationships between providers and

recipients either upstream or downstream of supply chain”. CRM mainly refers to activities such as sharing product information with customers, interacting with them to manage demand and satisfy their wants and needs, accept customer orders, having an order placing system, sharing order status with customers during order scheduling, and the product delivery phase (Lee *et al.*, 2007). CRM has been widely studied in the academic literature as it is considered a core and key element of successful SCM (Lee *et al.*, 2007; Li *et al.*, 2006; Li *et al.*, 2005; Tan *et al.*, 1998).

2.1.5 Internal Lean Practice

Lean has gained popularity in a wide range of industrial sectors, beyond manufacturing, all around the world (Garza-Reyes *et al.*, 2012). It is nowadays considered the most influential new paradigm in manufacturing (Forrester *et al.*, 2010) enhancing the competitiveness of organisations (Hines *et al.*, 2004). Lean is focused on identifying and eliminating waste throughout a product's entire value stream, extending not only within the organisation but also along its entire supply chain network (Boyle and Scherrer, 2009). Thus, the concept of lean supply chains has been widely studied in the academic literature (e.g. Chen *et al.*, 2013; Qrunfleh and Tarafdar, 2013). In most of the cases, these studies suggest that lean principles and practices enable the effective management of supply chains. This evidence contributed in considering this dimension as part of the SCM practices construct developed for this study.

2.1.6 Postponement

Postponement is defined by Li *et al.* (2006) as “the practice of moving forward one or more operations or activities (e.g. making, sourcing, and delivering) to a much later point in the supply chain”. Its main objective is to push final product completion as close to the final customer as possible in order to reduce inventories and minimise risk of unsold product (Ferreira *et al.*, 2015). This factor has been widely studied, tested and validated in the SCM literature by, among other authors, Ferreira *et al.* (2015), Li *et al.* (2006) and Li *et al.* (2005). This dimension has been included in the SC practices construct due to the highly instable demand environment in Jordan. Postponement might therefore be a fundamental element of supply chain practice for Jordanian manufacturing firms.

2.1.7 Total Quality Management

Total Quality Management (TQM) is a management philosophy which emphasises the necessity to meet the needs of internal and external customers as well as the importance of doing things correctly at the first time (Al-Khalifa and Aspinwall, 2000). Jabnoun (2002) argues that there is not an agreement, among authors, regarding what constitutes TQM. However, benchmarking, supplier relations, continuous improvement, customer satisfaction, empowerment and top management responsibility are the most cited elements of TQM in the academic literature (Garza-Reyes *et al.*, 2011). Although there is controversy regarding the results obtained from the implementation of TQM in relation to firm's performance (Mosadeghrad, 2014), the management of quality is one of the main constituents of SCM practices (Jraisat and Sawalha, 2013). This was the reason for including TQM as one of the dimensions of the SC practices construct.

2.2 SC Performance

Supply chain performance (SCP) has become a critical source of sustainable advantage in many industries (WH Ip *et al.*, 2011). SCP is defined by Banomyong and Supatn (2011) as “the efficiency which takes into account multiple performance measures related to supply chain members, as well as the integration and coordination of members' performance”.

According to Harland (1999), most of the traditional performance measures are oriented towards economic performance.

Various studies have suggested and used a set of new measures to respond to the current requirements for SCP measurement. Stevens (1990) presents SCP measurement in terms of service level, cost, throughput efficiency, inventory level, and supplier performance; while, SCP measures according to Pittiglio et al. (1994) fall into one of four categories: customer satisfaction/quality, cost, time, and assets. Spekman et al. (1998) used customer satisfaction and cost reduction as the SCP measure. Other qualitative SCP measures such as flexibility, information and material flow integration, customer satisfaction, supplier performance, and effective risk management were identified by Beamon (1999). As in practice it is not feasible to consider all the SCP dimensions found in the academic literature, those suggested by Beamon (1999) were adopted for this study as they are comprehensive and include all the dimensions of interest (see Figure 1). External-internal linkage between manufacturing firms and their supply chain facilitate reconfiguring their manufacturing systems exactly when needed to meet the requirements infused by market and/or suppliers and/or manufacturing requirements (Abdi and Labib, 2016). The external-internal linkage helps industries to update their information from the market that includes product demands and their life cycles in time, and from their suppliers that includes the parts and raw materials during the life cycles before ending demands. Table 2 presents the dimensions and their definitions.

Insert Table 2 in here

2.2.1 Flexibility of Supply Chain

According to Koh et al. (2007), flexibility is defined as “the firm’s ability to adapt to changes in its environment”. Many researchers included “velocity” and “speed” into their flexibility definition and emphasised that flexibility means doing things fast (Li *et al.*, 2006). Therefore, adaptation of “many suppliers” practice gives the firm an opportunity to increase flexibility of generating alternative sourcing for procurement by reducing SC risks (Koh *et al.*, 2007). Thus, building long-term partnership relations with suppliers and customers helps to improve the flexibility of the SC by creating a mutual understanding among the members (Chang *et al.*, 2005). Chopra and Meindle (2004) indicated that there are four dimensions of flexibility: customer service, order, location, and delivery time flexibility. In the literature, there are several types of flexibility: volume, dynamic operations, range, and response flexibility (Ferry *et al.*, 2007). Flexibility ensures that changes caused by risky events can be absorbed by the SC through effective responses (Skipper and Hanna, 2009).

Therefore, some studies found that much of manufacturing flexibility enhancement effort was not successful and in some situations, flexibility could actually lead to negative results (Upton, 1994). Thus, firms do not benefit from the matching of internal manufacturing flexibility in uncertain environment, while it seems that more flexibility is not equivalent to higher competitiveness. In contrast, there is another group of researchers who confirmed the positive impact of flexibility on firm performance, for example, Swamidass and Newell (1987), found the positive effect of product mix and new product flexibility on net profit rate and sales growth. Additionally, firms which offered various product options were able to increase their market share (Bolwijn and Kumpe, 1990), while, in other studies it is found

that there is a positive effect of volume flexibility on sales growth and net profits (Tannous, 1996).

2.2.2 Integration of Supply Chain

Integration is considered a core success factors for SCM because the implementation of SCM needs the integration of processes from sourcing, to manufacturing, and to distribution across SC (Stonebraker and Liao, 2006).

Various researchers have conceptualized SC integration in various ways, which refers to the extent to which separate parties are able to work together in a cooperative manner to arrive at mutually acceptable outcomes. Accordingly, this definition encompasses constructs pertaining to the degree of cooperation, coordination, integration and collaboration (Richey *et al.*, 2009). According to Frohlich and Westbrook (2001), there are two types of integration along the SC: the first type involves the forward coordination and integration of the physical flow of deliveries between suppliers, manufacturers, and customers; the other type involves the backward coordination of information and flow of data from customers, manufacturers, to suppliers. Narasimhan and Jayaram (1998) state that internal integration involves the coordination, cooperation and collaboration between all internal functions within the firm from raw material management through production, shipping, and sales; while, external integration emphasizes on the coordination, collaboration and integration with other members outside the firm such as suppliers and customers (Gimenez and Ventura, 2005). Magretta (1998) presents that higher level of SC integration will allow firms to meet customer wants and needs faster and more efficiently than non-integrated firms. Effective and superior SCM is directly related to highly integrated SC (Cook *et al.*, 2011). Therefore, SC strategies focus on how both internal and external business processes can be integrated and coordinated throughout the SC to better serve ultimate customers, while enhancing the performance of the individual SC members (Green Jr *et al.*, 2008).

2.2.3 Customer Responsiveness

Customer responsiveness is defined as the firm's speed in response to the customer orders and requests (Ramanathan *et al.*, 2011). Several researches pointed out that customer responsiveness is one of the most important factors that can be measured in the performance of SC. According to Owens and Richmond, (1995), the main objectives of customer responsiveness are: increasing response to customer wants and needs, deriving costs out of the system and finally, turning savings into additional value for the customer. Effective performance measurement can be achieved based on SC metrics linked to customer satisfaction particularly (Banomyong and Supatn, 2011). Therefore, responsiveness is usually related with innovative products or products with short lead time, which describes the level of collaboration needed (Ramanathan *et al.*, 2011).

2.2.4 Supplier Performance

According to Beamon (1999), supplier performance is defined as suppliers' ability to deliver raw materials/components/products to the firm on time and in good condition. In practice, many firms emphasise on the importance to use a limited number of qualified suppliers due to the fact that a significant shift has occurred in the traditional adversarial buyer-seller relationship. Therefore, suppliers' involvement needs to identify buyers' expectations in terms of quality, quantity, delivery, service and price, and can help firms to improve them in overall quality, reduce costs and competition (Morrisey and Pitaway, 2006); when the

expectations are met, this relationship becomes valuable and it turns into a useful tool that helps the company achieve its objectives (Fierro and Rendondo, 2008).

2.3 Firms' Performance

Firms' performance is a composite construct that indicates the business performance of a company. Specifically, it refers to how well a firm fulfils its financial and market goals (Li *et al.*, 2006). The short-term objectives of SCM are mainly to reduce inventory, increase productivity and reduce cycle time of products and services, while long-term objectives are to increase profits, penetrating new markets, increasing quality, and increase market share for all units of the SC (Tan *et al.*, 1998). Fraser (2006) suggests that to achieve maximum business performance it is important to align or link operations, such as those of SCs, to financial metrics. In this line, Fraser (2006) comments that the better a company's system for measuring and tracking financial and operational performance, the more finances and operations improve. Thus, it is of paramount importance to investigate the effect that SCM practices have on the financial performance of manufacturing firms. This is done in this research through the manufacturing firms' performance construct (see Figure 1). In line with previous studies, which have considered the financial as well as market performance of firms (Li *et al.*, 2006; Zhang, 2001), this dimension has also been included as part of the performance construct (see Figure 1). Financial measures for typical firms include current and future sales, operational cost, changeover cost from producing a product type to another, transportation cost of raw materials and finished products, and current and future profit. Although, financial performance measures, and particularly profits are the major reason for the manufacturing firm's existence and its linkage to the supply chain, non-financial measures are also important to determine the SCP and MFP.

Balanced Score Card can be used to evaluate firms' performance. Balanced scorecards can be used for MP and SCP with consideration of financial indicators derived from historical information of the company's financial stance, and non-financial indicators inheriting short-term, long-term, and operational targets to satisfy all stakeholders reflecting outcomes of the manufacturing firm in terms of success/failure. Using balanced scorecards external performance measures related the nature of the relationship between the manufacturing firm and suppliers and customers are taken into account.

3. Research Methodology

The methodology adopted in this study followed the guidelines recommended in the reviewed literature (e.g. Li *et al.*, 2006; Li *et al.*, 2005; Tan *et al.*, 1998), which consisted of employing quantitative data collection procedures to facilitate the analysis and increase the validity and reliability of results. Thus, a questionnaire survey strategy was used in this study. The development of the instruments followed the four phases suggested by Li *et al.* (2006), namely: (1) item generation, (2) pre-pilot study, (3) pilot study, and (4) large-scale data analysis. The instruments and their items are presented in Appendix A.

3.1 Item Generation, Pre-pilot Study, and Pilot Study

Proper generation of measurement items of a construct determines the validity and reliability of an empirical research. Therefore, content validity is considered the main requirement for

an effective measurement. In this case, content validity was initially achieved through a thorough literature review on SCM practices. This permitted the generation of the items.

Instrument's validity, according to Fraenkel and Wallen (2003), ensures the ability of an instrument to measure the intended concept. Consequently, to achieve a good level of instrument validity, a five-point Likert scale paper-based questionnaire survey was revised-in the pre-pilot study. The initial pool of generated items-by three specialist academics in operations management and four industrialist practitioner experts in SCM (i.e. logistics, purchasing, operations management, and information systems) working in manufacturing firms. The objective of this revision was to ensure that each construct was properly and accurately addressed. The respondents were requested to provide feedback regarding the clarity of the questions as well as the organisation, logic, and length of the questionnaire. This helped to refine the instrument. Based on their feedback, redundant and ambiguous items were modified, eliminated, and new items were added wherever necessary.

Instrument's reliability refers to the “consistency of scores or answers from one administration of an instrument to another, and from one set of items to another” (Fraenkel and Wallen, 2003). Creswell (1994) states that the reliability score of an instrument indicates the stability and consistency of items contained and to what limit it measures the concept in a correct manner. The most popular test of reliability is Cronbach's alpha, which measures the internal consistency of an instrument. An alpha score of higher than 0.7 is accepted for all constructs of this study (Nunnally, 1978).

A small pilot study was performed using fourteen responses (n=14) out of fifty-four distributed to respondents similar to the target respondents. The survey was in English language with a cover letter introducing the research and briefly explaining its objectives, and including instructions for completion. It was responded by CEOs, presidents, vice-presidents, purchasing managers, supplying managers, operations managers, and planning managers. The total number of items removed after the pilot study was forty-three out of ninety-six. Table 3a, b, and c summarizes the results of the initial statistical analyses conducted during the pilot phase for all constructs. The responses were analysed using SPSS statistical software programme version 16. In this case, corrected-item total correlation (CITC) scores for each item with respect to a specific dimension of a construct were computed to purify the items. According to Cronbach (1951), the CITC score is a good indicator of how well each item contributes to the internal consistency of a particular construct as measured by the Cronbach's alpha coefficient. Thus, the next step was to determine the reliability coefficient (i.e. Cronbach's alpha) and each item's and sub-construct's CITC. Finally, item correlation matrices were used to identify and drop items that did not strongly contribute to Cronbach's alpha for the sub-construct. The optional feature in SPSS - “Alpha if item deleted” statistic- was also used to determine if the item significantly contributed to alpha. This feature was particularly useful when an item appeared to fit more than one construct.

3.2 Large Scale Methods

This study targeted respondents with knowledge and experience on the operations and management of the supply chain of their firms. Thus, CEOs, presidents, vice-presidents, purchasing managers, supplying managers, operations managers, and planning managers were sought as the main source of information. They were requested to refer to their major customers and suppliers when addressing relevant questions. This study included a total number of 498 firms from manufacturing sectors such as food processing, beverages, oil derivative products, furniture, apparel, textile, chemical, tobacco and cigarettes, paper and packaging, cement, potash, phosphates, fertilisers, rubber products, electrical equipment,

plastics, etc. All these firms had been in business for at least 5 years and employed a minimum of 51 workers.

E-mail was considered the most effective method for the distribution of the questionnaires. Szwarc *et al.* (2005) suggest that this distribution strategy has certain advantages that include quicker distribution, more professional appearance and lower cost. These advantages, according to Kirkham *et al.* (2014), contribute to increase the response rate. Cohen *et al.* (2007) acknowledge that a response rate of 30–35% provides statistical significance, while Cook *et al.* (2000) state a response rate of between 27 and 56% is acceptable. Of the questionnaires distributed 249 were returned, of which all were useable, giving an overall response rate of 50%. Besides exceeding the percentage of response rate indicated by Cohen *et al.* (2007) and Cook *et al.* (2000) to achieve statistical significance, the number of firms surveyed was also higher than comparable studies, for example, those conducted by Li *et al.* (2006) and Li *et al.* (2005). The final survey data was analysed using a number of statistical techniques such as correlations, regressions, and structural equation modelling (SEM). We used SEM analysis to cross verify the findings of the correlations and regressions as well as to provide support for our proposed hypotheses.

4. Analysis of Results

To test the significance of the constructs' relationships presented in Figure 1, three hypotheses (i.e. H1, H2 and H3, see Figure 1) were formulated.

4.1 Relationship between Supply Chain Management Practices and Supply Chain Performance

To test the relationship between SCM practices (SCMP) and supply chain performance (SCP), null (H0) and alternative hypothesis (H1) regarding the non-statistical and statistical association between these two constructs were respectively created to form hypothesis 1 (H1). Initially, the effects of the SCMP construct, and its seven dimensions, on every one of the four dimensions (i.e. SC flexibility, SC integration, customer responsiveness, supplier performance) of the SCP construct were analysed. However, to obtain an overall insight into the impact of all SCMPs together on the SCP of manufacturing firms, an overall analysis including all the dimensions of the SCMP and SCP constructs was conducted. Table 4 presents the results of the (a) linear regression, (b) ANOVA and Pearson correlation computations for the overall analysis.

Insert Table 6 in here

Tables 4(a) and 4(b) indicate that all SCMPs have a statistical significant difference $p < 0.05$ and the proportion of variance explains 50.6% ($R^2=0.506$); the F-value was 168.926. This means that there is a significant positive impact and hence indicates that there is a relationship between all SCMPs, when considered together, and SCP. Furthermore, the results shown by Table 4(c) suggest that the Pearson coefficient (r) for H1 is 0.637, while the correlation has a probability (p) value of 0.000 for 2-tailed test. A moderate, but still statistically significant positive correlation was found. Thus, the null hypothesis (H0) for H1 was rejected at $p < 0.05$ level, suggesting that there is a statically significant effect of the SCMPs adopted by Jordanian manufacturing firms on the performance of their supply chain.

To further verify the findings of the correlations and regressions, a full-fledged structural equation model was constructed (see Figure 2). The best fit SEM model confirmed the findings of the previous analysis by showing a positive linkage between supply chain management practices and supply chain performance. The fit indices of the SEM model shown in Table 5 indicate that all of them are within the acceptable ranges, thus validating the model. The path coefficient value between SCMP and SCP was found to be significant (.59) at $p < .01$ level, hence showing the positive causal linkage between SCMP and SCP.

4.2 Relationship between Supply Chain Management Practices and Firms' Performance

Null (H_0) and alternative hypotheses (H_2) were also set to test the non-statistical and statistical significance of the relationship between the SCMP and manufacturing firms' performance (MFP) constructs. This resulted in the formulation of hypothesis 2 (H_2 As part of an initial study, the effects of the SCMP construct, and its seven dimensions, was analysed in relation to the market share and financial performance dimensions of the MFP construct. However, to obtain an overall insight into the impact of all SCMPs together on the performance of manufacturing firms, an overall analysis including all the dimensions of the SCMP and MFP constructs was conducted. Table 6 presents the results of the (a) linear regression, (b) ANOVA and Pearson correlation calculation for the overall analysis.

Insert Figure 2 in here

Insert Table 5 in here

Tables 6(a) and 6(b) show that all SCMPs have a statistical significant difference $P < 0.05$ in relation to all MFP dimensions together. This suggests that all SCMPs play an important role and have a significant positive and direct effect on the overall MFP. The proportion of variance explains 73.3% ($R^2=0.733$); the F-value was 678.504. This means that there is a significant positive impact and hence indicates that there is a relationship between all SCMPs, when considered together, and all MFP dimensions. In addition, the results shown in Table 6(c) indicate that the Pearson coefficient (r) for this hypothesis is 0.856, while the correlation has a probability (p) value of 0.000 for 1-tailed test. Thus, a strong positive and statistically significant correlation was found. For this reason, the null hypothesis (H_0) for H_2 was rejected at 0.05 level, suggesting that there is a statically significant effect of the SCMPs adopted by Jordanian manufacturing firms on their firms' performance. The outcome of the SEM analysis also supported the findings of the correlations and regressions as the path coefficient (.26) was found to be significant at $p < .01$ level, thus showing that SCMPs have a positive influence on the MFP.

Insert Table 6 in here

4.3 Relationship between Supply Chain Performance and Firms' Performance

In order to test a third hypothesis (H3) to investigate the relations between SCP and MFP, null (H0) and alternative (H3) hypotheses related to the a non-significant (H0) and significant (H1) relationship between these two constructs were formulated. As part of an initial study, the effects of the SCP construct, and its four dimensions, was analysed in relation to the market share and financial performance dimensions of the MFP construct. However, to obtain an insight into the overall impact of the SCP of Jordanian manufacturing firms on their firms' performance, an overall analysis including all the dimensions of the SCP and MFP constructs was conducted. Table 6 presents the results of the (a) linear regression, (b) ANOVA and Pearson correlation calculation for the overall analysis.

Insert Table 7 in here

The results shown in Tables 5(a) and 5(b) suggest that the total SCP dimensions have statistical significant differences $P < 0.05$ in relation to all MFP dimensions together. This means that all dimensions of the SCP play an important role and have a significant and direct positive impact on the overall performance of manufacturing firms. The proportion of variance explains 73.3% ($R^2=0.733$); the F-value was 666.158. This means that there is a significant positive impact and an existent relationship between all SCP dimensions together and total MFP dimensions. Moreover, the results shown in Table 7(c) indicate that the Pearson coefficient (r) for H3 is 0.854, while the correlation has a probability (p) value of 0.000 for 2-tailed test. Hence, a strong positive and statistically significant correlation was found. Therefore, the null hypothesis (H0) for H3 was rejected at 0.05 level. A positive path coefficient (.62) in the SEM model further verified the findings of the correlation and regression analysis.

4.4 Summary of Results

The three hypotheses formulated and tested in the previous sections represent three causal relationships in the theoretical research framework, see Figure 1, studied in this work. The analyses and findings are summarised in Table 8. In general, they indicate that there are significant and direct relationships between SCMPs and SCP; SCMPs and MFP; and SCP and MFP. These findings were also verified using the SEM analysis as path co-efficients were found to be positive, thus showing the positive causality between the SCMP, SCP and MFP. We also tested the role of MFP as a mediating variable however our analysis shows that the mediation effect of MFP was not stronger than the direct effect of SCMP on SCP.

Insert Table 8 in here

Table 9 presents a summary of the correlation matrix for the three proposed hypotheses. This table indicates that SCMPs directly affect SCP (H1). Thus, SCMPs are considered vital and have an impact on improving the SCP of manufacturing firms. Therefore, these practices play a vital role to facilitate the flow of products and raw materials and for enhancing the SCP efficiency of these firms ($R^2=0.406$). The results in Table 9 also show that the Pearson coefficient (r) for H1 is 0.637; the correlation has a probability (p) value of 0.000 for 2-tailed test. Hence, a moderate positive and statistically significant correlation was found. Therefore, H0 was rejected for H1; see Table 8, at the 0.05 level.

The direct relationship between SCMPs and MFP indicates that SCMPs directly affect MFP. This suggests that, within the context of manufacturing firms, the adoption and successful implementation of SCMPs will directly improve their financial and market share performances in the long-run. This effect is in line with comparable previous studies found in the literature (Shin *et al.*, 2000; Tan *et al.*, 1998), which had not taken into consideration any intermediate variable(s) such as competitive advantage or SCP. The results show that there exists an immediate impact of SCP on MFP. MFP is also indirectly influenced by SCP. The results shown in Table 9 indicate that the Pearson coefficient (r) for H2 is 0.856; the correlation has a probability (p) value of 0.000 for 2-tailed test. Hence, a strong positive and statistically significant correlation was found. Therefore, H0 was rejected for H2; see Table 8, at the 0.05 level.

Finally, the direct relationship between SCP and MFP indicates that SCP directly affects MFP. This suggests that well-managed and well-executed SCP in terms of flexibility and integration of the SC, responding quickly to customers, and having a few highly dependable suppliers will directly have a positive effect on MFP. The results shown in Table 8 indicate that the Pearson coefficient (r) for H3 is 0.854; the correlation has a probability (p) value of 0.000 for 2-tailed test. Hence, a strong positive and statistically significant correlation was found. Therefore, H0 was rejected for H3; see Table 7, at the 0.05 level.

Insert Table 9 in here

5. Research implications and limitations

5.1 Research implications

This research has several important practical and theoretical implications. Firstly, the traditional paradigm of competition between firms has shifted to a competition between supply chains (Andersen and Skjoett-Larsen, 2009; Li *et al.*, 2006). For this reason, more and more firms are increasingly adopting SCM practices to achieve cost-reductions, improving their efficiencies and quality, and ultimately enhancing their competitiveness. However, there are still doubts regarding the potential benefits of SCM over existing practices and under certain environmental conditions (Trkman and McCormack, 2009; Meehan and Muir, 2008). Thus, the findings of this study confirm that effective SCM is a potentially valuable approach in improving supply chain and firm's performance through the adoption of some specific SCM practices, e.g. those presented in the SCMP construct shown in Figure 1. The findings of this research thus demonstrate and highlight the importance of SCM practices to firms.

Secondly, since SCM has been poorly defined and hence there is a high degree of variability in its meaning and understanding (Li *et al.*, 2006; Cigolini *et al.*, 2004), various researchers have identified several practices of SCM that firms can adopt. For instance, many firms still consider SCM as simply being related to purchasing and supplier management (Banfield, 1999), or as a synonym of transportation and logistics management that focuses on inventory reduction (Rudberg and Olhager, 2003). In this line, although most firms recognise and emphasise the importance of adopting SCM practices, many of them still do not know exactly what and which practices they should implement. The findings of this study demonstrate that firms should not only focus on traditional SCM activities such as purchasing and supplier management or transportation and logistics management but also consider the importance of more contemporary SCM practices, including building strategic supplier partnership, leveraging the level of information sharing with trading partners, and

implementing an effective internal lean system. Therefore, the results of this study should encourage these firms in developing the effectiveness of these practices. In this context, this study has provided SC managers of manufacturing firms, particularly those in developing economies, with a useful multi-dimensional operational measure of the construct of SCM practice for assessing the comprehensiveness of the current SCM practices of their firms.

The research findings are generic and can be adapted to the supply chains of any manufacturing industry e.g. automotive industries and eclectic/electronic production with variable demands in a developing country with similar logistic infrastructure to that of Jordan. The findings can assist manufacturing managers and researchers to better understand elements influencing supply chain performance in developing countries with similar characteristics. Similar developing countries can include Middle Eastern countries, that are emerging economies experiencing manufacturing growth, developing essential transportation infrastructure, fundamental IT and communication infrastructure e.g. Internet, suitable legislation for information sharing across the supply chain tiers, and potential capability for integration of supply chain. The proposed model can be adapted to the supply chain network along with adjustment of the research findings for informed decision and policy making.

Production type of the beneficial industry is not limited to specific products or processes that may include manufacturing/assembly industries with multi-stage manufacturing supply chain. However, the reconfiguration parameters may vary from a system to another and must be redefined accordingly.

5.2 Research limitations

Despite the practical and theoretical contributions of this research, it presents various constraints. First, this study only relies on a quantitative research methodology based on the collection and analysis of hard numerical evidence. In future studies there is a need to follow this type of methodology for all constructs and then gather qualitative data to explore their relationships to not only validate the results from this research, but also expand its context by obtaining more in-depth insights on firms' attitudes, thoughts, and actions, specially related to their SCM practices and the relationships with the constructs studied.

Second, in this research, a limited number of SCM practices were considered. These SCM practices were selected, based on the literature review and the input from practicing managers as those that would be the most important for the specific case of manufacturing firms. Therefore, some other SCM practices and constructs, such as infrastructure and competitive advantage, can also be considered for future research. This is part of the future research agenda derived and proposed from this study. Finally, we are proposing that Jordan is a typical case of a developing economy but there is a broad range of development stages for countries and further research in more countries on the spectrum of development would provide more insight into the practicalities of developing the antecedents of SCP presented in this paper.

6. Conclusion

This study represents a significant large-scale empirical effort to explore the causal relationships of SCM practices with SCP and MFP within the context of the Jordanian manufacturing sector. Different definitions of SCM exist in the academic literature (Cigolini *et al.*, 2004; Li *et al.*, 2006), while most of the empirical research has mainly focused on either the upstream or the downstream side of SCs. In this context, few studies have empirically considered both sides of SCs simultaneously (Li *et al.*, 2006). The theoretical

framework proposed to conduct this study considers both sides of SCs. This study thus aims at contributing by stimulating scholars to further study this area in depth, which will lead to a better understanding the SCM theory. Based on this, firms can develop a deeper and richer knowledge on their SCs to help them formulate more effective strategies for their effective management.

To investigate and test the theoretical framework, data was collected through a questionnaire survey responded by 249 Jordanian manufacturing firms, and the framework tested by using linear regression, ANOVA and Pearson correlation. The results obtained from these analyses were further validated using SEM. This study contributes to the body of knowledge in the SCM field in a number of ways. First, this study provides a theoretical framework that explores and identifies multiple constructs, and dimensions, of SCM, including SCM practices, SC performance, and firms' performance. In future research this framework can be extended by adding more constructs and/or dimensions. The constructs could include relevant aspects that may influence supply chains and their performance, for example, a country's infrastructure and firms' competitiveness.

Second, this study provides strong support of evidence to the literature regarding the impact of SCM practices on various performance dimensions. The results indicate that a higher level of adoption, implementation, and improvement in SCM practices will directly lead to improve SC and overall firms' performance. In addition, a higher level of SCM practices will also lead to a higher level of SC performance. Most industrial firms' theories, for example, competitive strategy, cost analysis and political economy all highlight the importance and emphasise the implementation of SCM (Li *et al.*, 2006). Therefore, the results of this study provide the empirical support to these theories. Third, the results of this study indicate and highlight the best and specific SCM practices that can be adopted by Jordanian manufacturing firms to improve their SC and overall firms' performance.

The research findings also emphasise that the proposed conceptual framework used for the Jordanian manufacturing supply chain can be well applied to other developing countries with similar capabilities and circumstances. The proposed model and the research findings have the potential to help policy makers to design better policies for supply chain and performance measurement..

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Tables

Table 1. Definitions of SCM in the Literature

Author(s)	Definition
<i>Integrated Logistics Management</i>	
Beamon (1999)	SCM is an integrated process wherein raw materials are manufactured into final products, then delivered to customers (via distribution, retail, or both).
Ellinger (2000)	SCM is the integration of all activities associated with the flow and transformation of goods from the raw material stage, through to the end user, as well as the associated information flows through improved inter-and intrafirm relationships to achieve sustainable competitive advantage.
Turban <i>et al</i> (2004)	SCM is the flow of materials, information, payments, and services from raw material suppliers, through factories and warehouses, to the end customers.
<i>Purchasing and Supply Management</i>	
New and Payne (1995), Scott and Westbrook (1991)	SCM is a chain linking each element of the manufacturing and supply process from raw materials through to the end user, encompassing several organizational boundaries.
Christopher and Juttner (2000)	SCM is concerned to achieve a more cost-effective satisfaction of end-customer requirements through buyer-supplier integration.
<i>Integrated SCM</i>	
Zhao <i>et al</i> (2002), Cooper <i>et al</i> (1997), Lee <i>et al</i> (2007).	SCM is a process of integrating/utilizing and co-ordinating products and information flows among suppliers, manufacturers, distributors, retailers and customers, so goods should be produced and delivered at the right quantities, at the right time, and at the lowest cost, whilst satisfying customer requirements.
Chopra and Meindle (2001)	SCM is a set of approaches and practices to effectively integrate suppliers, manufactures, wholesalers, distributors, and customers for improving the long-term performance of the individual firms as well as supply chain as a whole in a cohesive and high-performing business model.

Table 2. Definition of Supply Chain Performance

Dimension	Definitions	Literature
Flexibility of Supply Chain	Flexibility reflects a firm's ability to effectively adapt/respond to change that directly impacts a firm's customer.	Xiao (2015); Beamon (1999)
Integration of Supply Chain	The extent to which all activities within the firm, and its suppliers, customers, and supply chain members are integrated together.	Alfalla-Luque <i>et al.</i> (2015); Huang <i>et al.</i> (2014); Frohlich and Westbrook (2001)
Customer Responsiveness	The firm's speed in response to customer orders.	Reichhart and Holweg (2007); Beamon (1999)

Supplier Performance	Suppliers' ability to deliver raw materials/components/products to the firm on time and in good condition.	Huang <i>et al.</i> (2014); Beamon (1999); Shin <i>et al</i> (2000); Tan <i>et al</i> (1998).
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Table 3a. Summary of SCMPs Construct-Initial Statistics (Pilot study)

Item	Initial Corrected Item-Total Correlation	Final Corrected Item-Total Correlation	Initial Alpha	Final Alpha
(a) SCMPs construct				
Strategic Supplier partnership (SSP)				
SCMP/SSP1 Our firm relies on a few dependable suppliers.	0.76	0.84		
SCMP/SSP2* Our firm considers quality factor one of main criterion in selecting our suppliers.	0.21			
SCMP/SSP3* Our firm provides any help to improve the quality of suppliers' products.	0.33			
SCMP/SSP4* Our firm has continuous improvement programs that include our key suppliers.	0.39			
SCMP/SSP5* Planning and goal-setting activities in our firm are included in our key suppliers.	0.41			
SCMP/SSP6* New product development processes in our firm is included in our key suppliers.	0.17			
SCMP/SSP7* Our firm certifies our suppliers for quality.	0.35			
SCMP/SSP8 Our suppliers dealing with us in an open and honest way.	0.83	0.86		
SCMP/SSP9 Our suppliers have high reliability.	0.78	0.81		
SCMP/SSP10 Our firm relies on a few high quality suppliers.	0.85	0.87		
SCMP/SSP11 Our transactions with suppliers don't have to be closely monitored /supervised.	0.74	0.79		
SCMP/SSP12* There is a willingness from our suppliers to provide us with a lot of assistance without exceptions.	0.45			
SCMP/SSP13* We expect to leverage the business between us and our suppliers in the future.	0.51			
SCMP/SSP14 Our suppliers are highly committed to the agreements signed by us.	0.83	0.85		
SCMP/SSP15* There is a slimier understanding between us and our suppliers about aims and objectives.	0.44			
SCMP/SSP17* There is a slimier understanding between us and our suppliers about the importance	0.57		0.79	0.83
Level of Information Sharing (LIS)				
SCMP/LIS18 In case of any change needed, our partners will be informed in advance.	0.87	0.89		
SCMP/LIS19 Our firm sharing proprietary information with trading partners.	0.80	0.84		
SCMP/LIS20* If there are any issues that might affect our firm, our trading partners will keep us fully informed.	0.44			
SCMP/LIS21* Our trading partners share firm knowledge to develop our core firm's processes.	0.52			
SCMP/LIS22* Our firm exchange information with trading partners to establish our business planning.	0.38			
SCMP/LIS23 Our firm keeps in touch frequently with our trading partners and informs				

each other about any changes/events that may affect the other partners.	0.76	0.79	0.84	0.87
Quality of Information Sharing (QIS)				
SCMP/QIS24* Information exchange between our firm and our partners is timely.	0.22			
SCMP/QIS25 Information exchange between our firm and our partners is accurate.	0.79	0.83		
SCMP/QIS26 Information exchange between our firm and our partners is complete.	0.88	0.90		
SCMP/QIS27* Information exchange between our firm and our partners is adequate.	0.39			
SCMP/QIS28 Information exchange between our firm and our partners is reliable.	0.76	0.80	0.89	0.91
Customer Service Management (CSM)				
SCMP/CSM29 Our firm frequently interacts with customers to be responsiveness, reliable, and other standards.	0.81	84		
SCMP/CSM30 Our firm frequently follow-up and monitor our customers for quality/service feedback.	0.88	0.92		
SCMP/CSM31 Our firm frequently measure and evaluate customer satisfaction.	0.90	0.93		
SCMP/CSM32* Our firm frequently tries to determine future customer expectations.	0.55			
SCMP/CSM33* Our firm provides and facilitates any assistance for our customers.	0.48			
SCMP/CSM34 Our firm periodically assess the importance of our relationship with customers.	0.84	0.86	0.75	0.79
Internal Lean Practices (ILP)				
SCMP/ILP35 The firm policy looking for reducing set-up time.	0.80	0.83		
SCMP/ILP36* The firm adopts a “Pull” production system.	0.27			
SCMP/ILP37 Firm pushes and encourages suppliers for shorter lead-times.	0.85	0.87		
SCMP/ILP38 Firm streamlines ordering, receiving, and other works from suppliers.	0.88	0.89		
SCMP/ILP39* Suppliers’ warehouses/factories are located very close.	0.47			
SCMP/ILP40* Time has been reduced for inspection of the incoming materials/components/Products.	0.50		0.80	0.84
Postponment (PO)				
SCMP/PO41* Our products are designed for modular assembly.	0.45			
SCMP/PO42 Production process in our firm can be re-arranged and some processes can be carried out later on at distribution centres.	0.74	0.79		
SCMP/PO43 Our firm is able to delay assembly activities for final product until customer orders has actually been received.	0.92	0.94		
SCMP/PO44* Our firm is able to delay assembly activities for final product until the last possible position (or nearest to customers) in the supply chain.	0.41			
SCMP/PO45 Our goods are stored at appropriate distribution points close to the customers in the supply chain.	0.79	0.83	0.82	0.86
Total Quality Management (TQM)				
SCMP/TQM46 Top management in our firm is actively develops an integrated quality plan to meet business objectives.	0.81	0.84		
SCMP/TQM47* Top management in our firm encourages employee to be involvement in quality management and improvement activities.	0.53			
SCMP/TQM48* Top management in our firm offers all resources required for employee education and training.	0.19			
SCMP/TQM49 Our firm has an accurate and efficient database that provides information on internal operations, costs, and finances.	0.86	0.87		
SCMP/TQM50*Production equipment’s are maintained frequently according to maintenance plan.	0.46			
SCMP/TQM51 Our firm implements various inspections effectively and frequently.	0.91	0.93		
SCMP/TQM52*Our firm uses quality control and statistical process control for process control and improvement.	0.27			
SCMP/TQM53 Our firm has quality circles and cross-functional teams.	0.77	0.81		
SCMP/TQM54*Employees in our firm have an opportunity to be actively involved in quality-related activities.	0.56			
SCMP/TQM55*Employees have a high responsibility and very committed to the success of our firm.	0.29			
SCMP/TQM56 Our firm has a salary promotion and incentives for encouraging employees’ participation in quality improvement.	0.83	0.87		
SCMP/TQM57*Excellent suggestions are appreciated from our firm and financially rewarded.	0.35			
	0.44			

SCMP/TQM58* Employees' rewards and penalties are obvious and clear for all in our firm.	0.54			
SCMP/TQM59* Employees in our firm are encouraged to accept new skills and training programs.	0.93	0.93		
SCMP/TQM60 Our firm offers all resources required for employees training programs.	0.89	0.91		
SCMP/TQM61 Most employees in our firm are trained on how to use different equipment's and tools.	0.44 0.52			
SCMP/TQM62* Our firm collects extensive complaint information from customers.	0.91	0.93		
SCMP/TQM63* Our firm has a program to maintain good customer communication.				
SCMP/TQM64* Our firm treats customer complaints based on quality criteria and with top priority.	0.78	0.79		
SCMP/TQM65 Our firm always conducts a customer satisfaction survey annually and collecting their suggestions for improving our products.	0.43 0.33			
SCMP/TQM66* The reliability of the primary products in our firm is increasing.	0.93	0.93		
SCMP/TQM67* Durability of the primary products in our firm is increasing.	0.86	0.90	0.87	0.89
SCMP/TQM68 The performance of the primary products in our firm is increasing.				
SCMP/TQM69 The defect rates of the primary products in our firm are decreasing.				

*Denote items were deleted.

Table 3b. Summary of SCP Construct-Initial Statistics (Pilot study)

Item	Initial Corrected Item-Total Correlation	Final Corrected Item-Total Correlation	Initial Alpha	Final Alpha
(b) SCP construct				
Flexibility of Supply Chain (FSC)				
SCP/FSC1* Our supply chain is able to deal with different nonstandard orders.	0.31			
SCP/FSC2 Our supply chain is able to offer special customer specifications.	0.76	0.79		
SCP/FSC3 Our supply chain is able to produce different features of products such as: options, sizes, and colours.	0.79	0.82		
SCP/FSC4* Our supply chain is able to adjust capacity (accelerate/decelerate) in production regarding to rapidly customer demand changes.	0.37			
SCP/FSC5 Our supply chain is able to introduce large numbers of product improvements.	0.91	0.92		
SCP/FSC6* Our supply chain is able to offer/introduce new products for customers.	0.54			
SCP/FSC7 Our supply chain is able to respond to the needs and wants of the firm's target market.	0.87	0.88	0.74	0.78
Integration of Supply Chain (ISC)				
SCP/ISC8 All functions in our organization have high level of coordination and communication.	0.80	0.82		
SCP/ISC9 Cross-functional teams are usually used for process design/improvement firm.	0.84	0.87		
SCP/ISC10 Information systems encompass all functions in our firm, which provide high level of integration.	0.91	0.92		
SCP/ISC11* There are many cross-over activities between our firm and our trading partners.	0.28			
SCP/ISC12* There is a full system visibility in our supply chain from suppliers' suppliers to customers' customers.	0.45		0.88	0.90
Customer Responsiveness (CR)				
SCP/CR13 Our firm fills customer orders on time without delay.	0.77	0.79		
SCP/CR14* Our firm has short order-to-delivery time.	0.39			
SCP/CR15 Our firm is fast in customer response time.	0.87	0.89	0.87	0.89
Supplier Performance (SP)				
SCP/SP16 Our suppliers provide us materials/components/products on time				

Table 5. Fit Indices for the Best Fit SEM Model

Fit Indices	NFI (>.90)	RFI (>.90)	IFI (≈1.0)	TLI (≈1.0)	GFI (>.90)	CFI (≈1.0)	Chi-Square	df
Best Fit model	.965	.937	.982	.966	.947	.981	89.9	43

Table 6. Results of the (A) Coefficients of SCMPs and MFP (N=249), (B) ANOVA and Pearson Correlation Analyses for the Overall SCMPs and MFP Relationship

Table 7. Results of the (a) Coefficients of SCP and MFP (n=249), (b) ANOVA and Pearson Correlation Analyses for the Overall SCP and MFP Relationship

Table 8. Summary of Causal Relationships for the Theoretical Research Framework and the Formulated Hypotheses

	→
	→
	→

Note: *value is significant at $\alpha < 0.05$

Table 9. Correlations Matrix for Proposed Hypotheses (n=249)

Figures

Appendix A. Instrument developed to investigate (a) SCM practices adopted by Jordanian manufacturing firms, and the relationship between these practices with (b) SC and (c) firms' performance.

(a)

STRATEGIC SUPPLIER PARTNERSHIP

Relationship and criteria of strategic supplier

- 1) Our firm relies on a few high quality suppliers.
- 2) Our firm considers quality factor one of main criterion in selecting our suppliers.
- 3) Our firm provides any help to improve the quality of suppliers' products.
- 4) Our firm has continuous improvement programs that include our key suppliers.
- 5) Planning and goal-setting activities in our firm are included in our key suppliers.
- 6) New product development processes in our firm is included in our key suppliers.
- 7) Our firm certifies our suppliers for quality.

Trust of strategic supplier

- 8) Our suppliers dealing with us in open and honest way.
- 9) Our suppliers have high reliability.
- 10) Our suppliers deal with the information that provided by us in a confidential way.
- 11) Our transactions with suppliers don't have to be closely monitored /supervised.

Commitment of strategic supplier

- 12) There is a willingness from our suppliers to provide us with a lot of assistance without exceptions.
- 13) ...

- 14) §3) Our firm provides and facilitates any assistance for our customers.
- Sh 34) Our firm periodically assesses the importance of our relationship with
- 15) our customers.

INTERNAL LEAN PRACTICES

- 16) 35) The firm policy looking for reducing set-up time.
- 17) 36) Our firm adopts a "Pull" production system.
- 37) Our firm pushes and encourages suppliers for shorter lead-times.
- 38) Our firm streamlines ordering, receiving, and other works from suppliers.
- 39) Suppliers' warehouses/factories are located very close.
- 18)
- 19) 40) Time has been reduced for inspection of the incoming materials/components/
- 20) Products

POSTPONEMENT

- 21) 41) Our products are designed for modular assembly.
- 42) Production process in our firm can be re-arranged and some processes can be carried out later on at distribution centers.
- 22) 43) Our firm is able to delay assembly activities for final product until customer orders have actually been received.
- 23) 44) Our firm is able to delay assembly activities for final product until the last possible position (or nearest to customers) in the supply chain.
- 45) Our goods are stored at appropriate distribution points close to the customers in the supply chain.
- 24)

TOTAL QUALITY MANAGEMENT

Top management commitment

- 26)
- 27) 46) Top management in our firm is actively develops an integrated quality plan to meet business objectives.
- 28)
- 29) 47) Top management in our firm encourages employee to be involvement in quality management and improvement activities.
- 30) 48) Top management in our firm offers all resources required for employee education and training.

Continuous improvement

- 31) 49) Our firm has an accurate and efficient database that provides information
- 32) on internal operations, costs, and finances.
- 50) Production equipment is maintained frequently according to maintenance plan
- 51) Our firm implements various inspections effectively and frequently
- 52) Our firm uses quality control and statistical process control for process control and improvement.

Employee involvement

- 53) Our firm has quality circles and cross-functional teams.
- 54) Employees in our firm have an opportunity to be actively involved in quality-related activities.
- 55) Employees have a high responsibility and very committed to the success of our firm.

Reward and recognition

- 56) Our firm has a salary promotion and incentives for encouraging employees' participation in quality improvement.
- 57) Excellent suggestions are appreciated from our organization and financial rewarded.
- 58) Employees' rewards and penalties are obvious and clear for all in our firm

Education and training

- 59) Employees in our organization are encouraged to accept new skills and training programs.
- 60) Our firm offers all resources required for employees training programs.
- 61) Most employees in our organization are trained on how to use different equipment and tools.

Customer focus

- 62) Our firm collects extensive complaint information from customers
- 63) Our firm has a program to maintain good customer communication.
- 64) Our firm treats customer complaints based on quality criteria and with top priority.
- 65) Our firm always conducts a customer satisfaction survey annually and collecting their suggestions for improving our products.

Product quality

- 66) The reliability of the primary products in our firm is increasing.
- 67) The durability of the primary products in our firm is increasing.
- 68) The performance of the primary products in our firm is increasing.
- 69) The defect rates of the primary products in our firm are decreasing.

(b)

FLEXIBILITY OF SUPPLY CHAIN

- 1) Our supply chain is able to deal with different nonstandard orders.
- 2) Our supply chain is able to offer special customer specifications.
- 3) Our supply chain is able to produce different features of products such as: options, sizes, and colors.
- 4) Our supply chain is able to adjust capacity (accelerate/decelerate) in production regarding to rapidly customer demand changes.
- 5) Our supply chain is able to introduce large numbers of product improvements.
- 6) Our supply chain is able to offer/introduce new products for customers.
- 7) Our supply chain is able to respond to the needs and wants of the firm's target market.

INTEGRATION OF SUPPLY CHAIN

- 8) All functions in our firm have high level of coordination communication.
- 9) Cross-functional teams are usually used for process design/improvement in our firm.
- 10) Information systems encompass all functions in our firm, which provide high level of integration.
- 11) There are many cross-over activities between our firm and our trading partners.
- 12) There is a full system visibility in our supply chain from suppliers' suppliers to customers' customers.

RESPONSIVENESS TO CUSTOMERS

- 13) Our firm fills customer orders on time without delay.
- 14) Our firm has short order-to-delivery time.
- 15) Our firm is fast in customer response time.

SUPPLIER PERFORMANCE

- 16) Our suppliers provide us materials/components/products on time without delay.
- 17) Our suppliers provide dependable delivery to our firm.
- 18) Our suppliers are highly reliable when provide us materials/components/products
- 19) Our suppliers provide our firm high quality of materials/components/products.
- 20) Our suppliers provide our firm materials/components/products at lowest cost.

(c)
FIRM'S PERFORMANCE

	<u>Value (%)</u>
1) Market share.	<input type="text"/>
2) Return on investment.	<input type="text"/>
3) The growth of market share.	<input type="text"/>
4) The growth of sales.	<input type="text"/>
5) Growth in return on investment.	<input type="text"/>
6) Profit margin on sales.	<input type="text"/>
7) Overall competitive position.	<input type="text"/>

Note: Could you please, if there is any question is not obvious for you or any explanation, don't hesitate to contact the researcher on the address below:

Researcher: ~~Moh'd Anwer AL-Shboul~~

E-mail: mohammed.alshboul@gu.edu.jo, Mobile: +962-772306670

**THANK YOU FOR YOUR PARTICIPATION AND ASSISTANCE TO SUCCEES THIS
RESEARCH SYUDY**

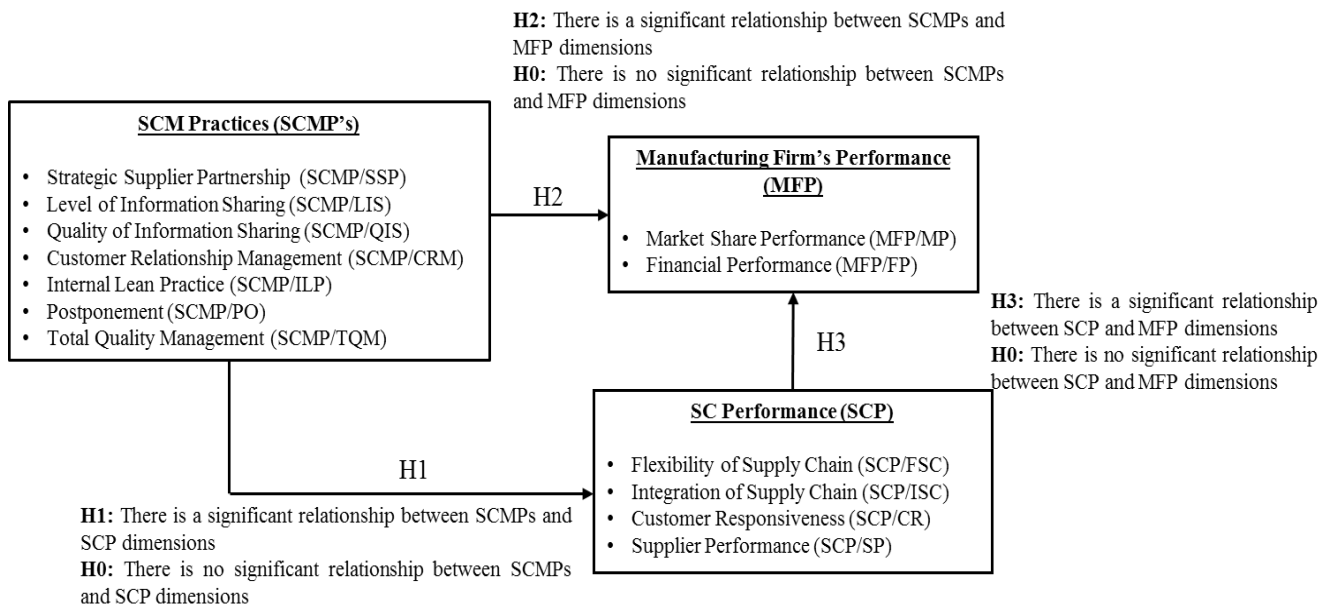


Figure 1. Research Framework

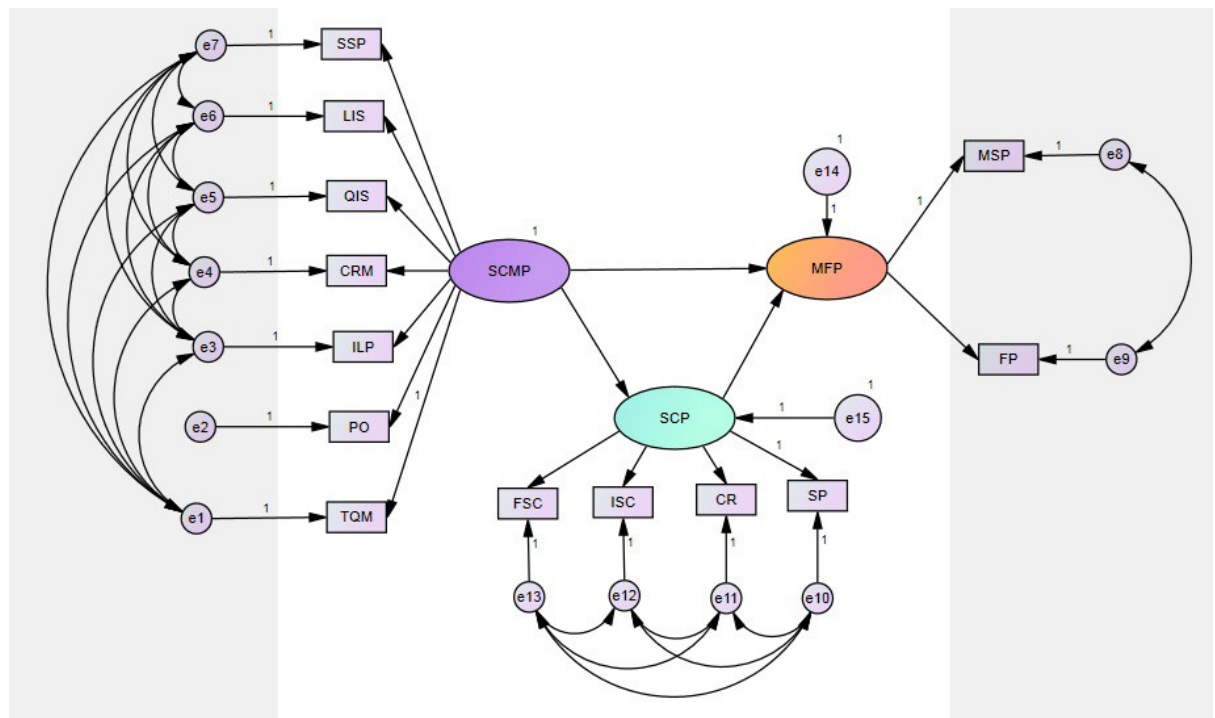


Figure 2. Best Fit SEM Model